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# Study of the contribution of the $^7$Be($d$, $p$) reaction to the $^7$Li problem in the Big-Bang Nucleosynthesis

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Our research goal is to measure the cross-section of the $^7$Be($d$, $p$) reaction in search of a solution to the cosmological $^7$Li problem (CLP). The CLP is the overestimation of primordial $^7$Li abundance in the standard Big-Bang nucleosynthesis (BBN) model compared to observed abundances, a major unresolved problem in modern astrophysics. A recent theoretical BBN model emphasized the primordial $^7$Li abundance is about three times larger than the recent precise observation [1], [2]. $^7$Li nuclei were considered to be produced predominantly by the electron capture decay of $^7$Be after the termination of nucleosynthesis in the standard BBN model. We focus on the $^7$Be($d$, $p$) reaction since it is considered one of the contributors to $^7$Be destruction in the BBN [3]. We developed a method to produce $^7$Be (half life = 53.22 days) target to measure the reaction cross-section in normal kinematics. The experiment was performed at the Tandem Electrostatic Accelerator, Kobe University [4]. A 2.36 MeV proton beam irradiated a natural-Li target to transmute $^7$Li particles to $^7$Be particles via the $^7$Li($p$, $n$)$^7$Be reaction [5]. We produced $3.03\times10^{13}$ $^7$Be particles in the target after two days of proton irradiation. After the target production, the beam ion was changed to deuterons and the $^7$Be($d$, $p$) reaction measured at energies 0.6, 1.0, and 1.6 MeV. The outgoing protons were measured by layered-silicon telescopes placed at 30 and 45 degrees. In this talk, I will report the experimental setup and preliminary results of this study, including the $^7$Be($d$, $p$) cross-section.\\
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References\par
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